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FOREST RESOURCES OF SOUTHWEST ALABAMA

A Progress Report

by

THE SOUTHERN FOREST SURVEY

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Regional Survey Director

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SOUTHERN FOREST EXPERIMENT STATION

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FOREWORD

The nation-wide Forest Survey, being conducted by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is: (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies can be formulated for the effective use of land suitable for forest production.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

This release, which should be regarded only as a progress report, is based on a field survey made Aug. 4 - Dec. 1, 1934, and April 6 - June 1, 1935. It contains Forest Survey data that will be included in complete reports to be published later, and that, although considered reliable, are subject to correction or amplification as the work of computation proceeds; while item 4 above, which is being studied on a national basis, is not discussed in this report.

In the presentation of these survey data, it is to be noted that owing to the sampling method used in collecting them, the greater the number of samples in any given classification the more accurate are the data for that classification. Hence classes that are of infrequent occurrence and relatively small in quantity generally cannot be determined with as high a degree of accuracy as classes that occur more frequently and in substantially greater quantities. Small tabular items are to be taken as showing, not the exact magnitude of the classes involved, but their relative magnitude in comparison with those of other classes.

Staff Assignment

Preparation of Report	- A. R. Spillers, Associate Forest Economist
In Charge of Field Work	- E. B. Faulks, Associate Forest Economist
In Charge of Computations	- P. R. Wheeler, Associate Forest Economist

Note: The Southern Forest Experiment Station hereby wishes to acknowledge the clerical assistance received from the Works Progress Administration in the preparation of this Release.

FOREST RESOURCES OF SOUTHWEST ALABAMA

General Description

An area of about 8 million acres in southwest Alabama, extending from the Gulf of Mexico northward into the western edge of the Black Belt Prairie, includes two Forest Survey units: Alabama #1 (the southern part of the area, with Covington, Escambia, Baldwin, Mobile, and Washington Counties), and Alabama #2 (the northern part, with Sumter, Choctaw, Marengo, Wilcox, Clark, Monroe, and Conecuh Counties). These two units, together, constitute a source of supply for Mobile, an important wood-using center. The southern part of the area, where turpentine and rosin are produced, is in the "naval stores belt"; and the northern part is in the "pine-hardwood region east of the Mississippi River." Approximately 71 percent of the land is forested (table 1) with various southern hardwoods, cypress, and longleaf, slash, loblolly, and other pines.

In addition to Mobile, the largest city, other cities and towns in the area are Andalusia, Prichard, Demopolis, Atmore, Opp, Brewton, and Florala although more than three-fourths of the total population of 423,000 (1930 Census) live in the country or in towns of less than 2,500 people. Approximately 210,000 live on farms, while many other rural residents live in small communities such as turpentine or lumber camps.

Agriculture (which provides work for approximately half of those gainfully employed) and forest industries are the principal sources of employment in this area. According to the Agricultural Census of 1935, there were 44,000 farms with an aggregate area of about 3 million acres, a decrease in area from 1920 of about 13 percent. The area in cropland, however, increased about 8 percent between 1924 and 1934. In 1935, about two-fifths of the farm area was woodland, which contributes not only important quantities of forest products, but gives part-time employment to many of the agricultural workers.

The rainfall averages between 55 and 60 inches per year, and the growing season lasts about 8 months. Cotton and corn are the principal crops, although many field and orchard crops are grown on a small scale. Dairying, cattle, and poultry raising are also important sources of farm income. Only a small part of the area is improved pasture, the usual practice being to let cattle graze throughout the forest. It is also noteworthy that there are over 300,000 acres of idle and abandoned cropland, much of which will probably revert to forest unless a period of prosperous farming should ensue. In this event, the best of the present idle and abandoned land may be cultivated again.

Southwest Alabama lies entirely within the Coastal Plain, and most of its soils are sands and clays, although limestone predominates in the small area of Black Belt Prairie included in these units. The entire area, which for the most part is gently rolling, is well drained by rivers that enter the Gulf of Mexico and that have a fall of 400 feet in elevation as they flow through the area. The Tombigbee and Alabama Rivers join within the unit and flow into Mobile Bay through a short delta, while the less important Conecuh River crosses northwest Florida before reaching the Gulf.

Table 1. - Total area classified according to land use, 1935

Land use	Southern part	Northern part	Entire area	
	Acres	Acres	Acres	Percent
Forest:				
Productive	2,985,900	2,743,800	5,729,700	70.6
Nonproductive	2,300	-	2,300	1/
Total forest	2,988,200	2,743,800	5,732,000	70.6
Agricultural:				
In cultivation:				
Old cropland	515,200	1,033,600	1,548,800	19.1
Newly cleared cropland	3,100	20,700	23,800	.3
Out of cultivation:				
Idle	49,900	116,700	166,600	2.0
Abandoned	53,900	81,400	135,300	1.7
Improved pasture	9,400	238,100	247,500	3.0
Total agricultural	631,500	1,490,500	2,122,000	26.1
Other nonforest	160,800	104,300	265,100	3.3
Total area	3,780,500	4,338,600	8,119,100	100.0

1/ Negligible.

Excellent shipping facilities by barge and flatboat are available from Mobile northward through the entire length of the area, chiefly on the Tombigbee and Alabama Rivers. To the north, the former gives access to the Birmingham area via the Black Warrior Rivers, while the Alabama River taps the Montgomery territory. Mobile, which is one of the South's busiest seaports, with an excellent deep-water harbor and well developed, state-owned shipping facilities, is also located on the Intracoastal Waterway. Several important railway systems and feeder lines provide adequate railroad transportation. While paved highways are scarce, gravel and graded roads form a transportation network that makes practically all of the area accessible to motor vehicles.

In general, the ownership of the land is unusually stable and tax default is rare. Farmers, wood-using companies, and naval stores operators are the principal landowners. The special Agricultural Census of 1935 classified as "land in farms" 3,174,500 acres, or over 39 percent, of the total area of 8,119,100 acres. Of the total land in farms, more than 44 percent is classed as either "woodland pasture" or "woodland not pastured." There are almost 44,000 farms, a farm being defined by the Census as "all the land which is directly farmed by one person, either by his own labor alone or with the assistance of members of his household, or hired employees." These farms, which vary greatly in size, average 72 acres, more than 32 acres of which are woodland.

As shown by table 2a, which was drawn from Census data, more than two-thirds of the total number of farms are small, i.e., less than 50 acres in size; and less than 2 percent of all the farms are large, containing 500 acres or more. The large farms, however, while making up less than 2 percent of the total number of farms, include 29 percent of the total farm acreage (table 2b). The aggregate area of all the small farms (less than 50 acres), on the other hand, is only 21 percent of the total area in farms. The northern part of this area has more than twice as many farms as the southern part and almost three times as many small farms.

From the standpoint of forestry extension work, these figures are very significant. To teach forestry to all the farmers will involve reaching in some degree the operators of all 44,000 farms; but if the extension work is limited as to funds and personnel, as it often is, it will be possible to begin by concentrating on the 750 large farms (500 acres or more), which include 29 percent of the total farm area.

Table 2a. - Number of farms by sizes

Size	Southern part		Northern part		Entire area	
	Farms	Proportion of total	Farms	Proportion of total	Farms	Proportion of total
Acres	Number	Percent	Number	Percent	Number	Percent
1 to 49	7,978	60.0	22,535	73.4	30,513	69.4
50 to 99	3,027	22.8	3,828	12.5	6,855	15.6
100 to 499	2,186	16.4	3,679	12.0	5,865	13.3
500 to 999	64	.5	384	1.2	448	1.0
1000 and over	37	.3	271	.9	308	.7
Total	13,292	100.0	30,697	100.0	43,989	100.0

Table 2b. - Acreage in farms by sizes

Size	Southern part		Northern part		Entire area	
	Farms	Proportion of total	Farms	Proportion of total	Farms	Proportion of total
Acres	Acres	Percent	Acres	Percent	Acres	Percent
1 to 49	204,262	22.1	468,360	20.8	672,622	21.2
50 to 99	213,539	23.1	265,501	11.8	479,040	15.1
100 to 499	368,623	40.0	726,946	32.3	1,095,569	34.5
500 to 999	42,530	4.6	261,872	11.6	304,402	9.6
1000 and over	93,861	10.2	528,964	23.5	622,825	19.6
Total	922,815	100.0	2,251,643	100.0	3,174,458	100.0

According to a recent extensive survey of forest-land ownership made by the Division of State and Private Forestry of Region 8 of the Forest Service, the forest-land ownerships of southwest Alabama are classified as follows:

	Acres
1. Large private ownerships:	
(a) Industrial, i.e., sawmill, pulpmill, naval stores, etc.	1,702,000
(b) Investment individuals and inactive corporations	760,000
2. Farm woodlands (1935 Census Report)	1,407,000
3. Publicly owned	
(a) Conecuh National Forest	68,000
(b) Other publicly owned lands (approximate)	107,000
4. Unclassified, private, nonfarm ownerships	1,688,000
Total forest acreage	5,732,000

A recent study of land ownership in 9 of the 12 counties in southwest Alabama, made by the Bureau of Agricultural Economics, in cooperation with the Works Progress Administration of Alabama, discloses that the land is held in 27,000 different ownerships. The small owners (under 100 acres) greatly predominate in number, but the comparatively few large owners (1000 acres and over) control about half the land. In table 3 the proportion of number of owners in different ownership-classes is shown separately for the two Survey units covered in this report.

Table 3. - Proportion of number and size of ownerships by size-classes

Size-classes	Southern part 1/		Northern part 2/	
	Proportion of number	Proportion of area	Proportion of number	Proportion of area
Acres	Percent		Percent	
Less than 100	69	14	60	13
100 - 259	20	15	24	17
260 - 499	5	9	8	14
500 - 999	3	10	5	15
1000 and over	3	52	3	41
Total	100	100	100	100

1/ Based on an aggregate area of almost 3 million acres in four of the five counties in the Unit.
2/ Based on an aggregate area of almost 3 million acres in five of the seven counties in the Unit.

The study shows that in the 9 counties 69 percent of the land was owned by persons residing in the same county, 10 percent by owners residing in an adjoining county, 6 percent by owners living elsewhere in Alabama, 10 percent by out-of-state owners, and 5 percent by public agencies or owners whose addresses were unknown.

The study also ascertained the business of the owner. For the nine counties studied, the proportion of the land area owned by different business groups is as follows:

Business group	Percent of area owned	Business group	Percent of area owned
Farm owner-operators	41	Wood-using industries	27
Merchants	3	Mining, power, & railroad companies	1
Professional men	2	Farming companies	1
Administrators & executors	4	All other businesses	3
Banks & mortgage companies	3	Unknown	10
Real-estate agencies	3	Governmental agencies (publicly owned land)	2
		Total	100

Forest Description

Almost three-fourths of the forest area is located on the rolling uplands that are found throughout the area. Topographic situations of less importance are river bottoms, which are fairly well distributed; swamps, bays, ponds, etc.; and flatwoods, found chiefly in the southern part bordering the Gulf Coast.

The type map (fig. 1), which shows only the broad distribution of dominant type-groups, is not intended to delineate either cleared land or intermingled small areas of other types. Longleaf and slash pine types, which are generally located in rolling uplands and flatwoods, usually are confined to the southern part of the area (table 4). Loblolly and other pine types, now occupying much of the land formerly dominated by longleaf pine, show a marked preference for the rolling uplands, especially the red clay hills in the northern part of the area, i.e., in Forest Survey Unit Alabama #2. The cypress and the bottomland and swamp hardwoods prefer the swamps, bays, ponds, and river bottoms; while the upland hardwoods and the scrub oak-scrub hardwoods are confined chiefly to the rolling uplands. The principal hardwood species are red and black gums and red and white oaks.

Of this entire forest area of southwest Alabama, there remains less than a million acres of old growth (table 4), three-fourths of which—since 10 percent or more of the sawlog-size trees have been removed—is classed as partly cut. The smallest sizes considered for saw timber by the Forest Survey are: pines and cypress, 9.0 inches in diameter at breast height (d.b.h.), $4\frac{1}{2}$ feet above the ground; and hardwoods, 13.0 inches d.b.h. The uncut old-growth stands average 8,900 board feet (green lumber tally) per acre, and the partly cut stands 4,000 board feet. Much of the old growth lies in a few, relatively large blocks, but a large area is in small, widely scattered patches. Approximately 44 percent of its area is in the hardwood and cypress types, 42 percent in longleaf and slash pines, and 14 percent in the loblolly and other pine types.

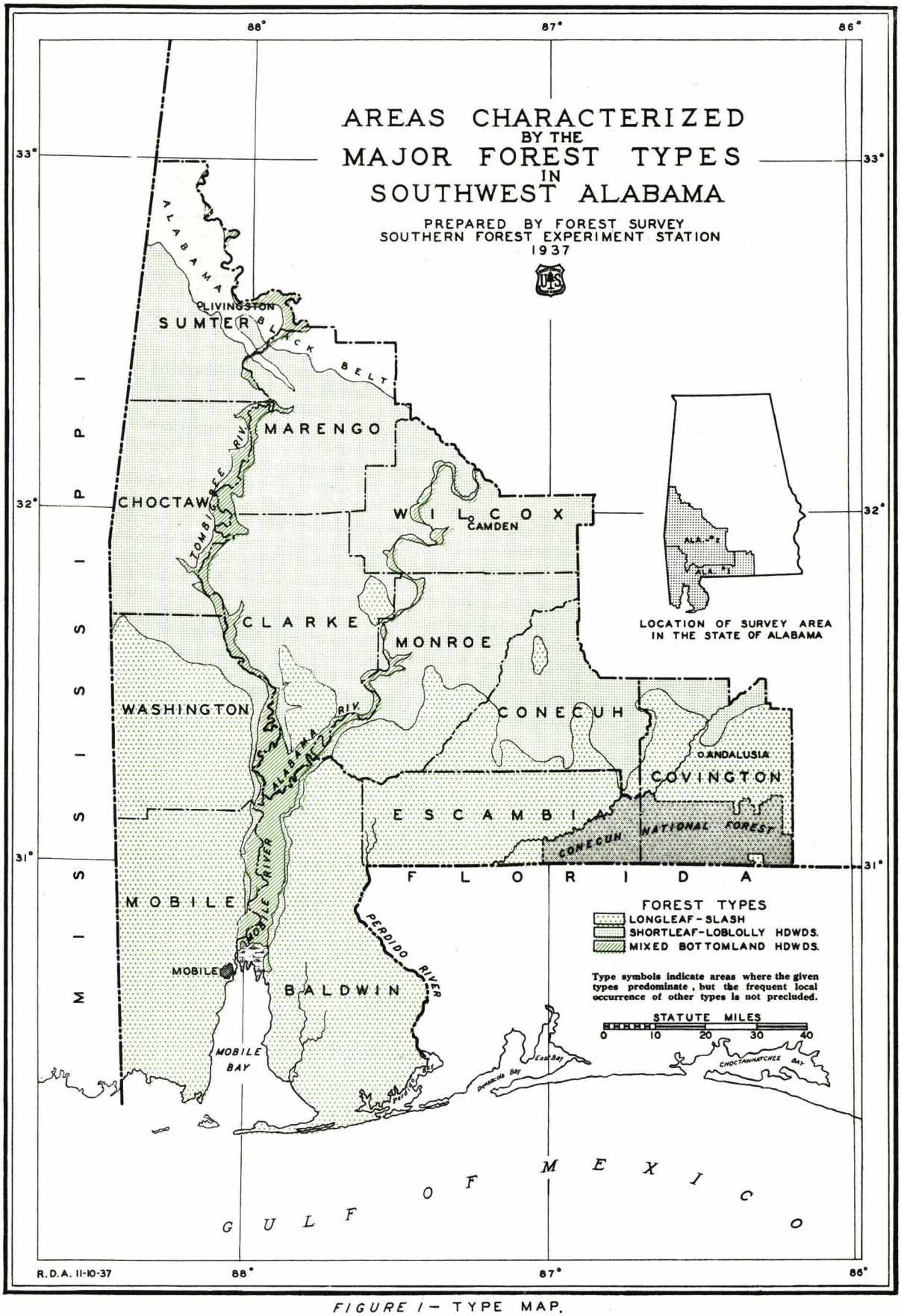


FIGURE 1 — TYPE MAP.

Second-growth stands covering almost 4½ million acres, or more than three-fourths of the forest area, occur in both large and small tracts in all parts of the area. The second-growth sawlog-size stands are well advanced, having, if uncut, an average volume of 3,700 board feet per acre, or, if partly cut, an average of 2,800 board feet per acre. There is a greater area of sawlog-size second-growth stands in the "loblolly and other pine" types than in all other types combined, and nearly twice as much as in longleaf and slash pines. The under-sawlog-size condition, which, from an areal standpoint is the most important of all, is found in all types, although chiefly in the longleaf and slash pines. These "sapling" stands, made up mostly of trees 1 to 7 inches d.b.h., average only 300 board feet per acre, largely in "remnant" trees.

Table 4. - Forest area classified according to type-group and forest condition, 1935

Forest condition	Forest type-groups designated by dominant species			All type-groups	Proportion of total forest area
	Longleaf and slash pines	Loblolly and other pines	Hardwoods and cypress1/		
	Acres				Percent
Old growth:					
Uncut	78,500	50,200	124,900	253,600	4.4
Partly cut	342,600	90,500	305,700	738,800	12.9
Total	421,100	140,700	430,600	992,400	17.3
Second growth:					
Sawlog size:					
Uncut	472,600	707,800	210,300	1,390,700	24.3
Partly cut	74,400	250,200	67,800	392,400	6.8
Under sawlog size	1,030,900	679,200	541,300	2,251,400	39.3
Reproduction	241,500	67,000	27,700	336,200	5.9
Total	1,819,400	1,704,200	847,100	4,370,700	76.3
Clear-cut	359,600	4,600	2,400	366,600	6.4
Total all conditions	2,600,100	1,849,500	1,280,100	5,729,700	100.0
Percent of total	45.4	32.3	22.3	100.0	
Southern part of area	2,213,100	257,600	515,200	2,985,900	52.1
Percent of southern part	74.1	8.6	17.3	100.0	
Northern part of area	387,000	1,591,900	764,900	2,743,800	47.9
Percent of northern part	14.1	58.0	27.9	100.0	

1/ Includes about 79,300 acres of the cypress type.

"Reproduction" is the term commonly applied to the youngest forest condition, in which seedlings and sprouts less than 1 inch d.b.h., standing 80 or more per acre, form the principal forest cover. About two-thirds of all the reproduction area is in the longleaf and slash pine types. In general, the new forest has the same species pattern as the old, except that, largely as a result of fire protection, the more prolific seeders such as the loblolly and slash pines are encroaching upon sites formerly held by longleaf pine, a species slow to reproduce. Before the turn of the century, longleaf pine dominated most of the area now held by loblolly pine in the northern portion. 1/ An analysis of reproduction plot data in the pine types is as follows:

General stocking classification	Longleaf and slash pine area (in the southern part)	Loblolly and other pine area (in the northern part)
	Percent of area	
Satisfactory (More than 900 well-distributed seedlings)	13	37
Fair (170 to 900 well-distributed seedlings, or 300 or more seedlings with fair distribution)	31	41
Poor (80 or more poorly distributed seedlings)	56	22
Total area	100	100

Clear-cut areas (involving about a third of a million acres, chiefly in the longleaf and slash pine types of the southern part) have less than 80 seedlings per acre and may or may not have seed trees. Many of these logged-over areas have had natural reforestation at one time or another, but it has been killed, usually by fire. In the future, some of the clear-cut areas may be reforested by natural seeding, if fires are controlled, for 37 percent of this area has three or more seed trees per acre, and 39 percent has one or two. The remaining 24 percent of the clear-cut area has no seed trees, and reforestation will depend upon seeding from the neighboring forest or upon planting.

The site quality or productivity of the forest, as indicated by the height in feet of dominant trees at 50 years (i.e., the site index), compares favorably with that of other Survey units in the lower South. Approximately 10 percent of the sites dominated by longleaf and slash pines have an index of 80 or more; 53 percent, 70; 36 percent, 60; and only 1 percent, 50 or less. Of the sites dominated by loblolly and shortleaf pines, 21 percent have a site index of 90 or more; 38 percent, 80; 28 percent, 70; and 13 per cent, 60 or less.

1/ See "Timber pines of the Southern United States" by Charles Mohr, U. S. Dept. of Agric., 1896. 160 pp. illustrated.

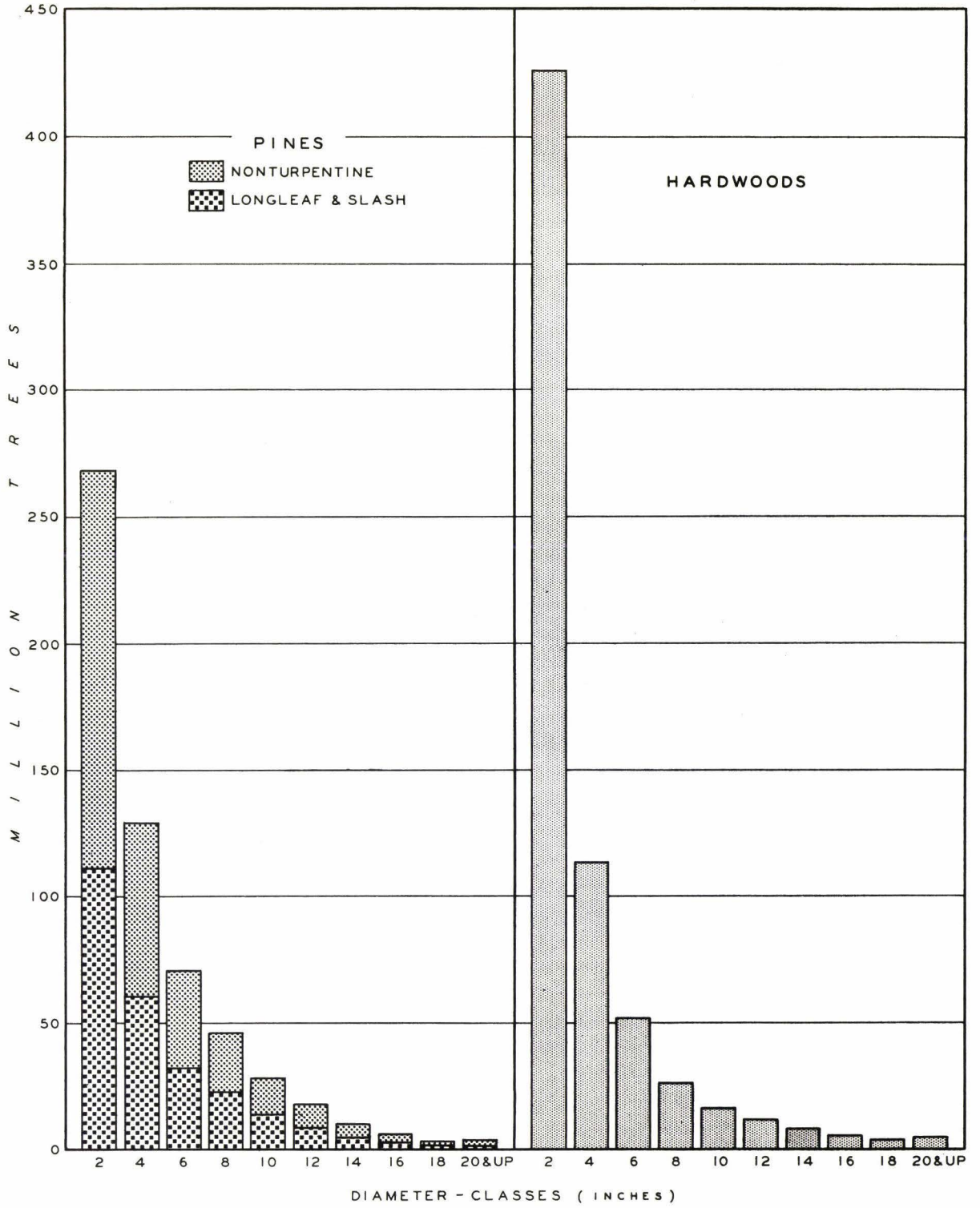


FIGURE 2 – STAND DIAGRAMS

Figure 2 shows the total number of pine and hardwood trees (cypress is included with hardwood) by 2-inch diameter-classes on the entire area. The fact that three-fourths of the trees are in the 2- and 4-inch classes indicates that at least the basis for future forest yields has been established. It also emphasizes the need for protection from fire, since without it the attrition by higher mortality will seriously reduce the future possibilities.

In order to compare the make-up of the present forest with that of a managed forest, charts showing the area and volume distribution by age-classes of the two forests are given in figure 3. Chart A is drawn for the $2\frac{1}{4}$ million acres of longleaf and slash pine types in the southern part, and Chart B for the $1\frac{1}{2}$ million acres of the loblolly and other pine types in the northern portion. Comparisons are made of age-class and volume distribution in the present forest with those of a theoretical forest managed on a rotation of 70 years——a period conceivably needed for the integrated production of lumber, poles, and pulpwood. The volume figures used are gross, since no deductions have been made for woods cull, although the volume in turpentined butts in the longleaf and slash pine trees is not included. As shown by the superimposed broken-line, the managed forest is divided into seven equal areas, one for each 10-year age-class; and its per-acre volumes are based upon the heaviest stocked 10 percent of the $\frac{1}{4}$-acre sample plots in the uncut stands now found on weighted-average sites. The pattern of the present forest (shown cross-hatched) is based upon a rough determination of the existing age-classes, with their areas and volumes per acre.

The comparison shown in Chart A for the longleaf-slash pine type-group discloses that the area occupied at present by the three younger age-classes, i.e., 0-10, 11-20,21-30, all of which are immature for any use except pulpwood from thinnings, is 50 percent of the type area instead of the 43 percent called for in an ideal age-class-by-area management plan. This is not a serious defect from the standpoint of long-time management, for with good treatment this area ultimately will come into production, but it accounts in some part for the comparatively low present output of the unit. The more serious defect shown by the comparison lies in the fact that in every age-class the stocking as shown by the cubic-foot volume of existing stands is only about one-third of what the land is capable under good management.

The comparison for the loblolly and other pine types (Chart B) discloses a fairly good distribution of age-classes by area, but the volumes-per-acre comparison indicates, for example, that for the 31- to 40-year age-class the present forest volumes per acre average less than half of those of corresponding stands of the managed forest.

It is interesting to note that the estimated potentiality under management of the loblolly and other pine types is considerably greater than that of the longleaf and slash pine types; for example, in the former, the estimated stand under management in the 61- to 70-year age-class approximates 3,200 cubic feet per acre, while the estimated stands in the same age-class in the latter type-group under management that includes turpentining do not greatly exceed 2,000 cubic feet per acre.

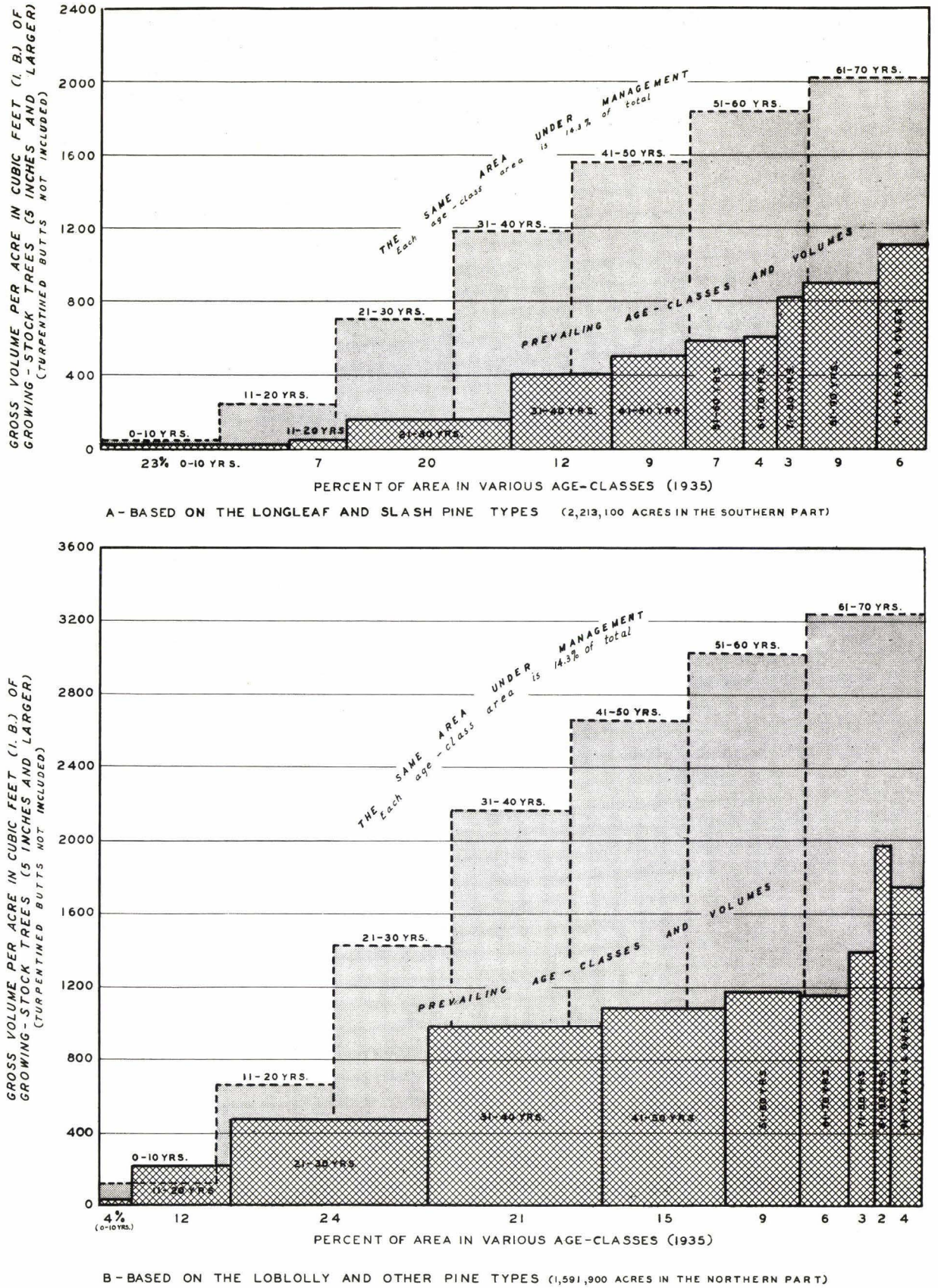


FIGURE 3 - PREVAILING AGE-CLASS AND VOLUME DISTRIBUTION COMPARED WITH THOSE ON THE SAME AREA UNDER MANAGEMENT.

Gum Naval Stores Industry and Resources 2/

Although only about 10 percent of the turpentine and rosin produced in the United States from gum and wood together comes from southwest Alabama, over 95 percent of the gum naval stores and all of the stump-distillation products that come from this territory are produced in the five southern counties that constitute Survey Unit Alabama #1.

Located in Alabama as far back as 1850, the gum naval stores industry at first depended upon the large old-growth trees, while in the present day it depends chiefly upon second-growth timber. The peak of production, which was reached about the period of the World War, was followed by a decline to a low point about 1925, coinciding closely with the exhaustion of the old-growth timber. Since 1925, there has been a slight increase owing to the fact that the second growth has reached working size, and according to the latest estimates, production of the area for the 1936-37 season (the turpentine year begins on March 1) was 46,400 units. 3/

In the 1936-1937 season for the entire area covered by this report, it is estimated that there were in operation more than 13 million cups, or some 1,300 "crops" of 10,000 cups each. The average yield per crop in 1936-37 was about 37 units, slightly less than the average for the whole naval stores belt. The total production in 1936 at Savannah prices was worth nearly 3 million dollars. About 855,000 man-days (10 hours each) of employment were provided, and about 110 stills were in operation. More than half of the operators were in Washington and Baldwin Counties, as shown by the map (fig. 4).

For the following analysis of the naval-stores resource situation, only the Survey Unit Alabama #1 is considered, since these five counties include over 80 percent of the turpentine area and over 95 percent of the production.

The section of southwest Alabama in which turpentine farming is actively carried on contains almost $2\frac{1}{2}$ million acres of forest land. Longleaf and slash pine stands occupy the greater part of the area, but there are intermixed areas occupied by non-turpentine pine and hardwood types, as well as areas of clear-cut forest land with or without reproduction in the seedling stage. The gum naval stores industry is based upon the use of the 233 million longleaf and slash pine trees that make up the greater part of the forest growing stock (table 5). Approximately 87 percent of these are second-growth trees less than 9 inches d.b.h. that have not been worked for turpentine.

2/ For additional information, see "Statistics on gum naval stores production," Forest Survey Release #17, Dec. 31, 1935, Southern Forest Exp. Sta., New Orleans, La. Also Gamble's International Naval Stores Year Book for 1937-38, "Gum naval stores operations of 1934-35 --their size and distribution and the employment provided by them," by Harry F. Smith and Elsa M. Rayl, Southern Forest Exp. Sta.

3/ A naval stores unit is made up of one 50-gallon barrel of turpentine and 3-1/3 500-pound (gross weight) barrels of rosin.

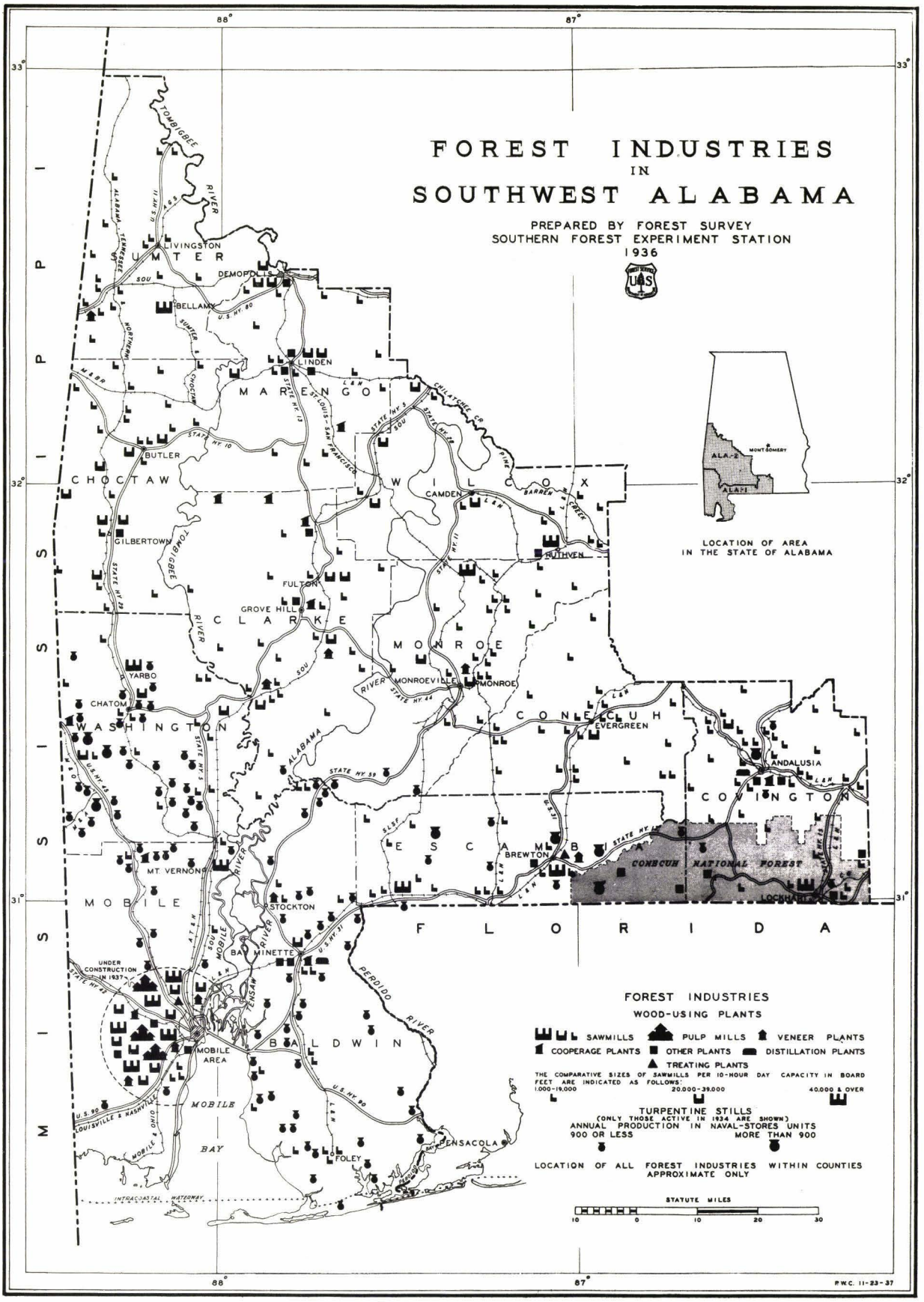


FIGURE 4—INDUSTRIES MAP.

Table 5. - Longleaf and slash pine trees on the various turpentine areas during the season 1934-35

Turpentine area	Round trees		Working trees	Resting trees	Worked-out trees	All turpentine pines	
	1.0 to 8.9 inches	9 inches and over					
	M trees						Percent
Round-timber area	123,139	11,117	-	378	13	134,647	57.9
Working area:							
Front-faced	22,967	511	5,265	137	144	29,024	12.5
Back-faced	25,514	178	4,949	384	462	31,487	13.5
Resting and worked-out areas	30,311	1,783	-	3,692	1,560	37,346	16.1
Total turpentine area	201,931	13,589	10,214	4,591	2,179	232,504	100.0
Percent of total	86.9	5.8	4.4	2.0	.9	100.0	

The turpentine forest area may be divided into three broad classes: (a) round-timber areas, in which the present stand of turpentine timber has not been operated for naval stores; (b) working areas, in which the turpentine crops have been cupped, and chipping and dipping operations are under way; (c) resting and worked-out areas, in which the crops have been worked for front faces and are now being rested before being back-cupped or have already been back-cupped. These latter crops can now be converted into wood products. The round timber area constitutes 57 percent of the naval stores territory; the working area, 22 percent; and the resting and worked-out area, 21 percent.

The forest areas in the three broad turpentine classes described above are occupied by timber stands in all stages of development as to number and size of trees and number of potential turpentine faces per acre. These stands range all the way from seedling areas, with a few scattered potential faces on residual trees, to areas of trees of turpentine size with many potential faces per acre. In general, the stands are of the selection type with three or more well-marked age-classes present on nearly every acre. As an aid in visualizing this aspect of the situation, the proportion of the area in these various stand conditions is graphically shown in figure 5 for the turpentine area as a whole and also for each of the major subdivisions. "Well-developed" stands shown in the figure average 24 future faces per acre, of which 11 are back faces and 13 are faces that can be placed on round trees at least 9 inches d.b.h. The minimum number of potential faces for this classification is 8 per acre. In addition to these trees 9 inches d.b.h. or larger, the well-developed stands average 102 smaller turpentine trees per acre, most of which, with reasonable fire protection, will grow to turpentine size. As shown in the figure, well-developed stands occupy about 40 percent of the forest area of the active turpentine region.

"Advanced sapling" stands consist chiefly of trees in the 8-inch diameter-class, associated with a large number of smaller trees. Stands of this class, which occupy about 11 percent of the forest area, can be expected to reach the well-developed stage and be ready for intensive turpentining in 8 to 15 years.

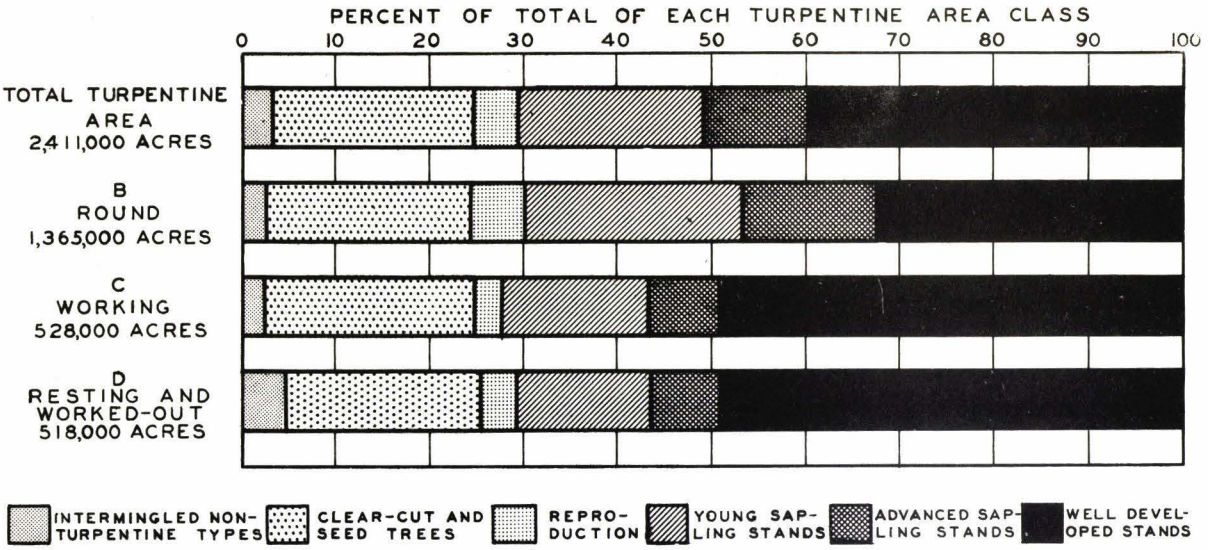


FIGURE 5 - CONDITION OF THE TURPENTINE AREA.

"Young sapling" stands, which are the next younger in order of development, are made up mainly of 2-, 4-, and 6-inch trees. There is a sufficient number of these trees now present to warrant the expectation that in 15 to 20 years, if protected from fire, these stands will be well enough developed in size and number of faces per acre to take their place as producers of naval stores. Young sapling stands at present occupy approximately 19 percent of the forest area of the local turpentine belt. The two remaining classes of stands, i.e., reproduction and clear-cut with or without seed trees, are in such early stages of development that they cannot be expected to be operable for 20 to 30 years, and then only if protected from fire and if not converted prematurely into pulpwood. These two young classes, together with the relatively small area in nonturpentine types, occupy about 30 percent of the forest area of the local turpentine belt.

An analysis of the inventory of the number of potential faces on the acreage of presently well-developed turpentine stands in round, working, and resting areas combined, indicates that there are sufficient future faces, assuming cupping to a 9-inch minimum diameter, to allow the placing of over 3 million new faces each year during the 8-year working cycle, 1935-1942. Such an income of new faces would be sufficient to maintain by annual recruitment a working body of turpentine crops approximately one and a half times the size of that being operated in the 1934-35 season. If the cupping practice is such as to include as much as one-third of the trees in the 8-inch diameter-class, the number of new faces with which to maintain the working body would be increased about 20 percent.

In the second 8-year cycle, 1943-1950, the analysis indicates that there should be an annual income of new faces amounting to about $3\frac{1}{2}$ million, assuming a 9-inch diameter limit. If one-third of the 8-inch class is counted in for cupping, the indicated annual income of new faces in this period would be over $4\frac{1}{2}$ million. In the third 8-year turpentine cycle, 1951-1958, the supply of young trees now on hand should, after discounting liberally for mortality on the basis of past experience, be sufficient in number and size to provide a further increase in the annual income of new faces and new trees with which to maintain turpentine operations.

All the above calculations of future supplies are based upon the assumption that the trees will not be cut for any purpose before they have been completely worked for naval stores, and that all the potential faces will be used. If the growing demand for pulpwood should cut heavily into the stock of round longleaf and slash pine; if the owners of any considerable amount of acreage should reserve their trees from turpentining in order to produce wood products exclusively; or if naval stores operators should, for any reason, change materially their woods practices, the supply of trees with which to maintain naval stores operations might be reduced considerably. There is a strong and wise tendency in the naval stores industry to increase the minimum diameter limit for cupping. Experience and the studies of the Southern Forest Experiment Station have shown that the working of trees under 9 inches d.b.h. generally is uneconomic. There is also a growing realization on the part of timber owners in the naval stores belt that a better income often can be obtained by managing for integrated wood products with naval stores as a supplementary yield than by operating for naval stores as the prime objective, with wood products as more or less of a salvage operation; this may have a tendency to change the future gum naval stores situation.

Table 6. - Net change in number of round trees 7 inches d.b.h. and larger and 9 inches d.b.h. and larger between Jan. 1, 1934, and Dec. 31, 1936

Item	1934		1935		1936	
	7 inches and larger	9 inches and larger	7 inches and larger	9 inches and larger	7 inches and larger	9 inches and larger
	Thousand trees					
Round trees as of Jan. 1	29,202	13,478	29,011	13,589	30,549	14,681
Increase due to growth of smaller trees	3,212	1,997	3,212	1,997	3,212	1,997
Decrease due to mortality	598	281	630	304	645	317
Net increase	2,614	1,716	2,582	1,693	2,567	1,680
Trees turpentined	2,539	1,446	718	409	1,499	854
Trees cut for products	266	159	326	192	299	157
Total industrial drain	2,805	1,605	1,044	601	1,798	1,011
Net change during year	-191	111	1,538	1,092	769	669
Round trees as of Dec. 31	29,011	13,589	30,549	14,681	31,318	15,350
Percent of number on Jan. 1, 1934	99.3	100.8	104.6	108.9	107.2	113.9

In table 6, the inventory as of 1934 is brought forward through 1935 and 1936 by the application of subsequent growth, mortality, and drain figures. The table indicates that the supply of round trees 7 inches d.b.h. and larger increased 7.2 percent between Jan. 1, 1934, and Dec. 31, 1936, and that during the same 3 years the supply of round trees 9 inches d.b.h. and larger increased nearly 14 percent.

Wood Naval Stores Industry and Resources

In 1936, two 4/ wood-distillation plants, both using the steam-solvent process, were making rosin, turpentine, pine oil, and other products from seasoned stumps and from the heartwood of dead, old-growth, longleaf pine trees. Approximately 59,000 tons of wood were consumed in 1936, with the industry providing 109,000 man-days of employment. The total production for the year amounted to about 7,000 barrels (50 gallons each) of turpentine, 36,000 barrels (500 pounds gross, each) of rosin and 5,000 barrels of pine oil, as well as other valuable commodities.

In 1934, the Forest Survey found that on 622,600 acres of forest land there was a stand per acre of at least 6 (average over 20) old-growth longleaf pine stumps at least 8 inches high; this stocking is usually considered heavy enough to warrant extraction (table 7). Over 91 percent of the stumpwood volvolume is in the rolling hills, while most of the remainder is in the flatwoods. The southern portion of southwest Alabama has over four-fifths of the wood naval stores resources in the area under consideration.

Table 7. - Stand of merchantable stumps (blasting basis), averaging 6 or more per acre

Stumps per acre	Area	Topographic situation		Total	Portion of total tonnage
		Rolling uplands	Flatwoods, swamps, bays, etc.		
	Acres	- - - - Thousand tons - - - - -			Percent
6 to 13	212,900	399	27	426	16.0
14 to 25	238,300	888	65	953	35.8
26 and over	171,400	1,156	129	1,285	48.2
Total	622,600	2,443	221	2,664 1/	100.0
Percent of total		91.7	8.3	100.0	

1/ In addition there are 64 thousand tons on 158,000 acres having 5 stumps or less per acre.

It is estimated that in 1934 there were suitable for blasting about 2,700,000 tons of stumps, averaging 6 or more per acre.5/ The Survey made no attempt to estimate the amount of seasoned topwood, which is also used in the production of wood naval stores. There were 1,300,000 tons of stumps in

4/ A third plant began operation in 1937 at Mobile.
5/ If mechanical stump pullers, which are often impractical in hilly country, could be used instead of blasting, the stumpwood recovered would be increased about two-thirds.

areas running 26 or more stumps, or over 5 tons of material, per acre. Clear-cut reproduction, and second-growth under-sawlog-size forest conditions together, contain 80 percent of the stumpwood resource, the remainder being fairly equally divided between the second-growth sawlog-size and the old-growth partly cut conditions. A potential resource of about 4 million tons (not shown in the table) is in unseasoned stumps and in the stumps that at present are not considered usable, owing to their location in dense stands of young growth that might be damaged in the process of extracting stumps. As rapidly as the present stands of old-growth longleaf and slash pine trees are cut and the resulting stumps are seasoned for about 10 years, there will be an additional supply of appreciable volume.

Estimates of Timber Volume

Saw-timber volume

To be classed as saw timber by the Forest Survey, a tree must have the following minimum specifications: It must be living; if pine or cypress, it must be at least 9 inches d.b.h. outside bark, or, if hardwood, 13 inches; and it must have 50 percent or more of its gross volume in sound material, or contain at least one sound 12-foot butt log. This area contains less than 8 billion board feet of saw timber according to the Doyle rule, the scale used locally, or more than 12 billion board feet, as measured by the International $\frac{1}{4}$-inch rule, which closely approximates green lumber tally (table 8). The volume figures given are net, in that allowance has been made for woods cull caused by rot, fire-scar, crook, limbiness, etc., as well as for loss in manufacture due to sweep and hidden defects. Examples of cull factors applied to reduce the gross volumes are:

Timber	Percent cull
Longleaf, old growth	10
Longleaf, second growth	4
Slash pines - all conditions . . .	5
Loblolly - all conditions	7
Red gum - all conditions	8
Cypress - all conditions	15

A flexible top-diameter limit, depending upon merchantability, is used; no pine or cypress logs less than $5\frac{1}{2}$ inches in diameter inside bark at the small end, and no hardwood logs less than $8\frac{1}{2}$ inches, are included. The average top diameters actually used considerably exceed these minima.

The pines, with loblolly pine having the most volume, include over two-thirds of the saw timber (green lumber tally). Almost three-fourths of the longleaf and slash pine volume is in the southern unit of this area, while over 84 percent of the loblolly and other pine volume is in the northern unit. Red gum, red oaks, black gum, and white oaks are the most important of the hardwoods. Grouped together as "other" hardwoods are yellow poplar, hickory, bay, beech, elm, hackberry, ash, and other species of less importance, such as magnolia, sycamore, basswood, and maple. Almost three-fourths of the total hardwood volume is in the northern counties. Cypress has only a small volume, mostly in the southern counties.

Table 8. - Net board-foot volume expressed in both Doyle scale and in green lumber tally 1/

Species	Southern part of the area		Northern part of the area		Southwest Alabama	
	Doyle scale	Green lumber tally	Doyle scale	Green lumber tally	Doyle scale	Green lumber tally
	Thousand board feet					
Pines:						
Longleaf	819,700	1,533,300	400,800	617,700	1,220,500	2,151,000
Slash	610,000	1,080,100	98,700	160,900	708,700	1,241,000
Loblolly	360,500	584,700	1,647,100	2,592,800	2,007,600	3,177,500
Other	93,100	159,200	833,200	1,383,300	926,300	1,542,500
Total pines	1,883,300	3,357,300	2,979,800	4,754,700	4,863,100	8,112,000
Hardwoods:						
Red gum	133,800	178,900	598,500	809,500	732,300	988,400
Black gum	263,600	382,500	139,500	199,100	403,100	581,600
Red oak	144,300	188,000	443,400	566,700	587,700	754,700
White oak	52,100	69,300	178,000	237,000	230,100	306,300
Other	190,900	277,800	721,500	961,300	912,400	1,239,100
Total hardwoods	784,700	1,096,500	2,080,900	2,773,600	2,865,600	3,870,100
Cypress	80,900	119,700	31,700	51,700	112,600	171,400
Total all species	2,748,900	4,573,500	5,092,400	7,580,000	7,841,300	12,153,500

1/ Green lumber tally is based on the International $\frac{1}{4}$-inch rule, which it closely approximates.

Second-growth stands, which include 57 percent of the saw-timber volume, are constantly becoming more important, although old-growth forest conditions, the partly cut stands of which have a greater aggregate volume than the uncut, still contain as much as 43 percent of the total saw-timber volume (table 9). About 34 percent of the total pine saw-timber volume is in old-growth stands; 59 percent of all the hardwood; and almost all the cypress. There is over three times as much pine in second growth conditions as hardwood and cypress combined.

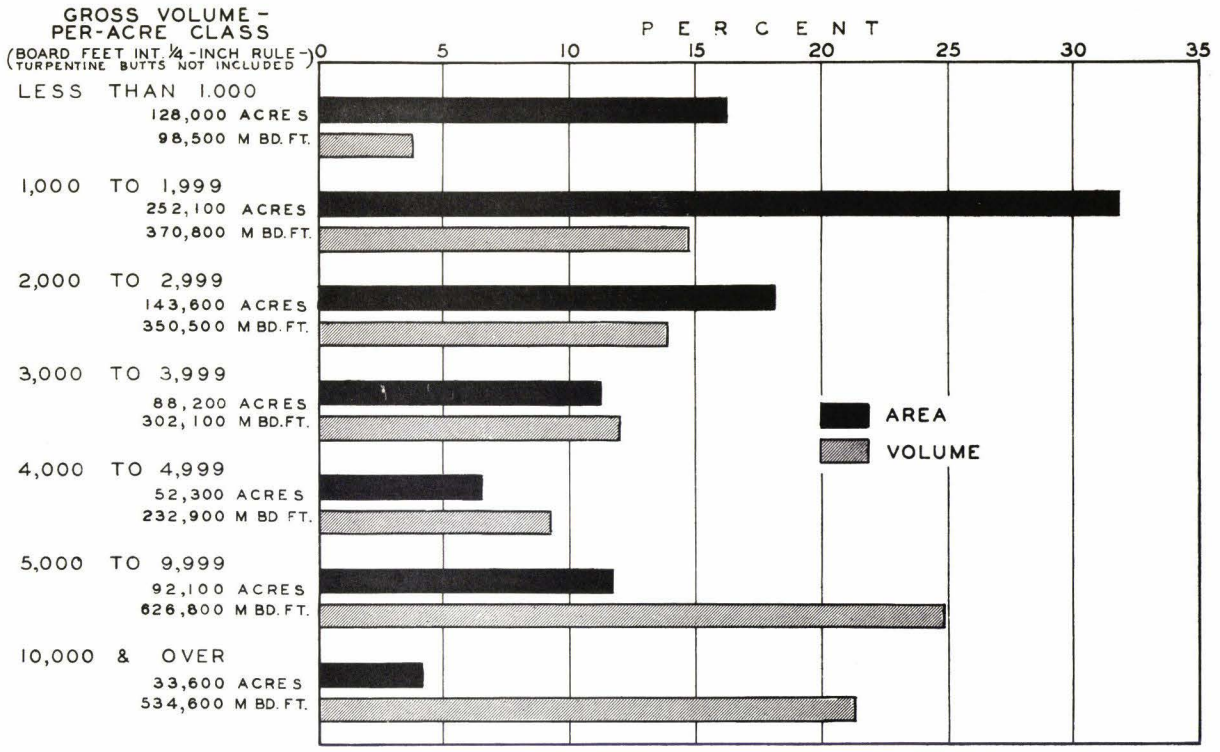
As a general rule, the old-growth trees are larger, and produce lumber of higher grades, than second-growth trees. In the two old-growth conditions combined, trees 17 inches d.b.h. and larger contain only 49 percent of the pine volume but over 61 percent of the cypress; and trees 19 inches d.b.h. and larger include nearly 59 percent of the hardwood saw-timber volume. Hardwood and cypress, all conditions combined, have a greater portion of their volume in large trees than do the pines.

Table 9. - Diameter distribution of net board-foot volume (green lumber tally, based on International ¼-inch rule) in the various forest conditions

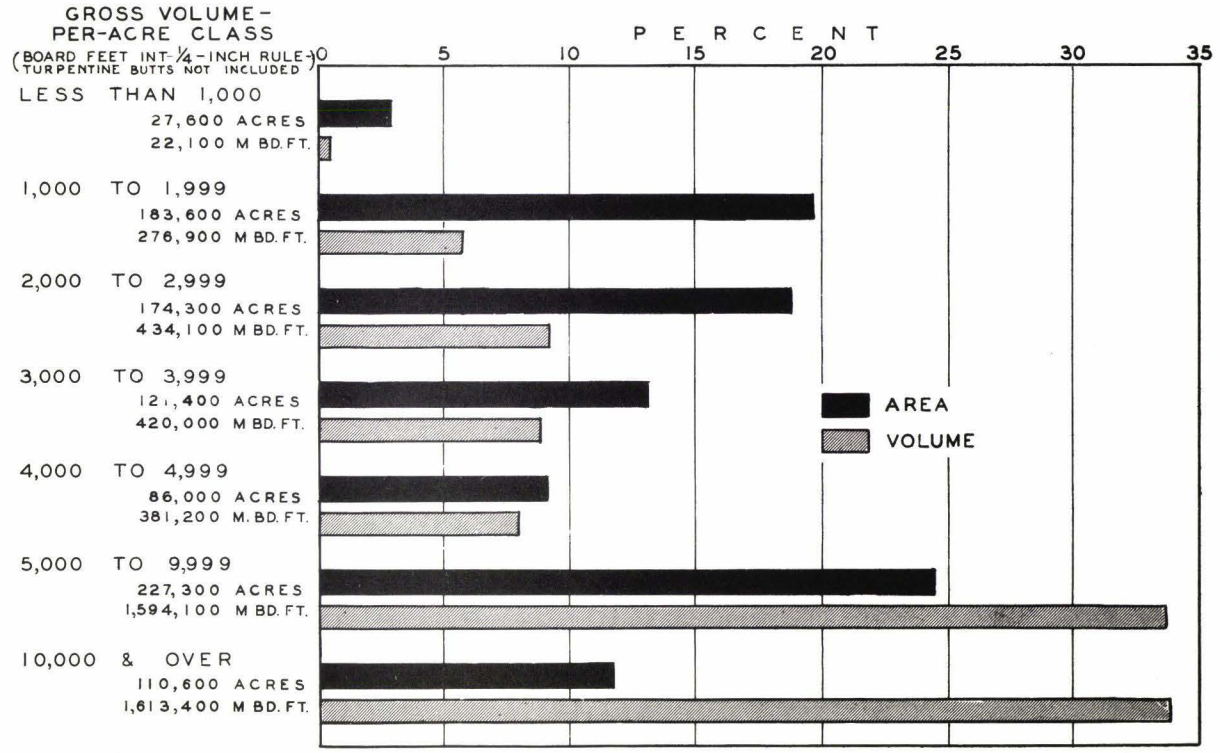
Species-group and diameter-class in inches	Old growth		Second growth		Total	Percent of total
	Uncut	Partly cut	Sawlog size	Under sawlog size 1/		
	Thousand board feet					
Pines:						
10 - 12	168,900	386,400	2,011,000	362,600	2,928,900	36.1
14 - 16	315,600	557,100	1,603,400	110,600	2,586,700	31.9
18 - 20	339,100	380,400	721,700	26,500	1,467,700	18.1
22 & over	405,400	224,500	485,800	13,000	1,128,700	13.9
Total pines	1,229,000	1,548,400	4,821,900	512,700	8,112,000	100.0
Hardwoods:						
14 - 18	355,400	580,400	951,900	175,200	2,062,900	53.3
20 - 28	416,300	612,700	384,100	48,900	1,462,000	37.8
30 & over	168,900	138,000	36,500	1,800	345,200	8.9
Total hardwoods	940,600	1,331,100	1,372,500	225,900	3,870,100	100.0
Cypress	75,200	65,900	19,700	10,600	171,400	100.0
Total all species	2,244,800	2,945,400	6,214,100	749,200	12,153,500	
Percent of total	18.5	24.2	51.1	6.2	100.0	

1/ Includes a small amount in the reproduction and clear-cut conditions.

In addition to quality, the volume density or stand per acre greatly influences the economic value of the stands, owing to the fact that logging costs per unit vary somewhat inversely with the volume. Proportional area and volume of the sawlog-size conditions are classified according to volume of saw timber per acre in figure 6, charts A and B. The volumes are gross, no deductions having been made for the woods cull, but on the other hand in the longleaf and slash pine trees, no volumes in turpentine butts have been included. While there is room for error in the lowest volume-per-acre class because the estimates are based on ¼-acre plots, the combined data in the first two classes are stronger. Chart A, for the longleaf and slash pine types in the southern portion of southwest Alabama, shows that 48 percent of the area, but only 19 percent of the volume, is in stands that have less than 2,000 board feet per acre; and it follows that 52 percent of the area and 81 percent of the volume are in stands of 2,000 board feet or more. In the loblolly and other pine types in the northern part (chart B), the preponderance of heavy stands is even more striking; here 77 percent of the area and 94 percent of the volume are in stands having 2,000 board feet or more per acre.



A — BASED ON THE LONGLEAF AND SLASH PINE TYPES (789,900 ACRES IN SOUTHERN PART)



B — BASED ON THE LOBLOLLY AND OTHER PINE TYPES (930,800 ACRES IN NORTHERN PART)

FIGURE 6 — PROPORTIONAL AREA AND VOLUME OF THE SAWLOG-SIZE CONDITIONS, CLASSIFIED ACCORDING TO VOLUME OF SAW TIMBER PER ACRE.

Cordwood volume 6/

The entire net usable volume of all live trees 5.0 inches d.b.h. and larger, including the saw timber shown previously, amounts to 64 million standard cords (4 x 4 x 8 ft.) with bark included (table 10). The item, "upper stems of saw-timber trees", includes the cordwood above the sawlog portion up to a flexible top-diameter limit that varies with the quality but is not less than 4 inches, outside bark. For hardwoods and cypress the usable limbs are included, while for pine the upper stems but no limbs are included. "Sound trees under sawlog size" include the full stem (without limbs) of pine and cypress trees 5.0 to 8.9 inches d.b.h., and of hardwoods 5.0 to 12.9 inches d.b.h., all up to a variable top-diameter limit but never less than 4 inches. In the fourth column, under "cull trees," is given the usable volume that may be salvaged if these undesirable cull trees, including the scrub oaks, are utilized. In cordwood-volume estimates, deductions for material unfitted for use because of fire scar, crook, bad knots, and other defects amounted to 1 to 10 percent by volume for the sound trees, and 20 to 80 percent for the cull trees.

Table 10. - Net volume of all sound material, expressed in cords

Tree species-group	Source of material				Total
	Sawlog portion of saw-timber trees	Upper stems of saw-timber trees	Sound trees under saw-log size	Cull trees	
	Cords				
Pulping species:					
Pines:					
Longleaf (round)	4,398,900	815,800	2,838,600	72,100	8,125,400
& slash (turpentined)	3,199,200	665,500	721,900	61,100	4,647,700
Loblolly & other pines	10,343,600	1,871,600	3,621,500	1,024,500	16,861,200
Total pines	17,941,700	3,352,900	7,182,000	1,157,700	29,634,300
Hardwoods (pulping)	5,286,000	2,830,900	6,052,400	4,833,100	19,002,400
Cypress	400,500	132,500	93,200	97,700	723,900
Total pulping species	23,628,200	6,316,300	13,327,600	6,088,500	49,360,600
Nonpulping hardwoods	4,121,000	2,390,500	3,973,300	4,551,300	15,036,100
Total all species	27,749,200	8,706,800	17,300,900	10,639,800	64,396,700
Percent of total	43.1	13.5	26.9	16.5	100.0

6/ For more detailed information, see "Pulping and nonpulping cordwood volume in the southwest Alabama survey area." Forest Survey Release #16, Southern Forest Exp. St., New Orleans, La., Oct. 18, 1935.

Approximately 46 percent of all the cordwood volume is pine (loblolly and other pines aggregate a greater volume than longleaf and slash), and 31 percent is pulping hardwood and cypress, giving a total of 77 percent, or 49 million cords, suitable for pulping. The principal pulping hardwood species are the soft-textured red gum, black gum, tupelo gum, yellow poplar, bay, magnolia, etc. Red oaks, white oaks, and scrub oaks contain the bulk of the 23 percent in hardwood volume now classed as "nonpulping," although it should be recognized that future developments in pulp- and paper-making technique may facilitate the using of these species.

From the standpoint of the future of the forest, it is significant that about half of the cordwood volume is in trees in the 6-, 8-, 10-, and 12-inch diameter-classes---sizes that must produce the saw timber of the future. At the same time, these young trees are in the sizes most desired for pulpwood.

Figure 7 gives the cordwood volume in sound trees only, including upper stems of pine and upper stems and usable limbs of hardwood and cypress; cull trees are not included.

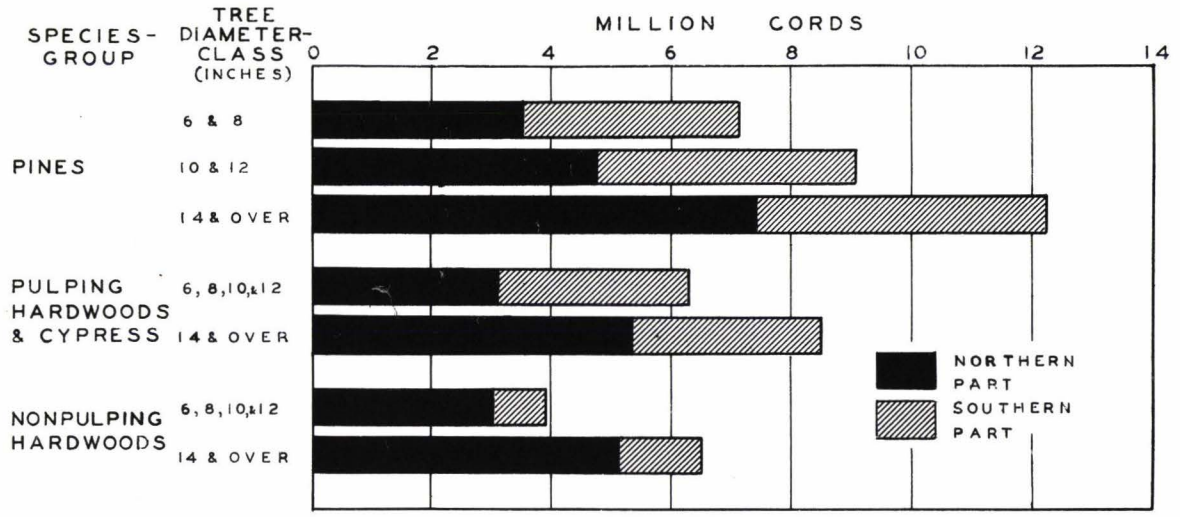


FIGURE 7- CORDWOOD VOLUMES OF PULPING AND NONPULPING SPECIES BY SIZE-CLASSES, SOUND TREES ONLY.

While the total volume of all usable material is over 64 million cords, only 48 million cords of this is in the sound-tree growing stock, because the growing stock, or the material for which increment was computed, does not include either the cull trees or the upper stems and limbs of hardwoods and cypress. Cull trees alone have a usable volume of almost 11 million cords, of which 6 million is in pulping species. The cordwood volume in cull pines alone, the main species now being cut for pulpwood, amounts to over a million cords. If this material were removed during the next 10 years, as it should be, it would take care of about half the requirements of two pulp mills 7/

7/ There is another pulp mill under construction at Mobile, but hardwoods may make up a large part of its cut.

and reduce correspondingly the drain on the growing stock during a period when such action would be most effective in building it up. In addition to the cull-tree volume, the worked-out turpentine pines contain over 700,000 cords of usable material. The removal of cull trees and trees that have been worked out for turpentine has always been a major problem for forest owners. The increasing market for pulpwood should make profitable this highly desirable stand-improvement measure.

Relative stands of growing stock per acre in cords for the various forest conditions and type-groups, computed by dividing total volumes by the corresponding areas, are usually greater in the northern than in the southern part of the area (table 11).

Table 11. - Average cordwood volumes per acre of growing stock

Location and forest type-group	Old growth		Second growth			All conditions 1/
			Sawlog size		Under sawlog size	
	Uncut	Partly cut	Uncut	Partly cut		
	Cords (bark included)					
Southern part: 2/						
Longleaf and slash pines	31.0	10.7	11.1	8.1	2.6	5.5
Loblolly and other pines	22.1	14.6	16.1	14.6	4.1	11.6
Hardwoods	20.3	14.0	12.8	12.8	2.2	8.0
Cypress	27.4	13.9	-	-	10.4	15.7
All types (weighted averages)	25.2	11.8	12.0	11.2	2.7	6.6
Northern part:						
Longleaf and slash pines	25.2	12.8	12.2	8.4	2.9	7.2
Loblolly and other pines	33.4	16.2	17.3	11.0	4.0	11.2
Hardwoods	25.7	14.2	13.2	10.6	4.1	10.3
Cypress	20.7	17.5	22.8	-	1.6	19.3
All types (weighted averages)	28.3	14.4	16.1	10.7	3.9	10.4

1/ Includes area of reproduction and clear-cut forest conditions in weighted average.

2/ For additional information, see "Volume on average acres in the principal units of the naval-stores region." Forest Survey Release #29, Southern Forest Exp. Sta., New Orleans, La., Oct. 30, 1937.

Poles and piles

The high price usually paid for poles and piles warranted special consideration of the trees that could be used for these products. It should be understood, however, that these trees were included in the saw-timber and cordwood inventories, because it is obvious that some of them will be used for lumber, pulpwood, and other products.

According to the estimate shown in table 12, which is believed to be conservative, there were in 1935 about 24 million trees suitable for poles and piles, based upon the specifications of the American Standards Association. Listed in order of occurrence were the round longleaf and slash pines, the loblolly and other pines, and the turpentined longleaf and slash pines. The last-mentioned group had scarred butts, the unusable parts of which were deducted in estimating the lengths. The southern counties included practically all of the longleaf and slash pine; the northern counties, the loblolly and other pine sticks. Approximately two-thirds of all pole and pile sticks were 20 or 25 feet long, and most of those remaining were 30 and 35 feet. Included in the column listed as "40 feet and over" are about 107,000 sticks at least 55 feet long. Approximately 59 percent of all the poles and piles are in trees 7.0 to 10.9 inches d.b.h.; 35 percent in trees 11.0 to 14.9 inches; and 6 percent in trees at least 15.0 inches, all diameters being taken outside of bark.

Table 12. - Pole and pile resources

Species-group	Length of poles and piles			Total	Portion of total
	20 and 25 feet	30 and 35 feet	40 feet and over		
	----- Thousand sticks ----				Percent
Round longleaf and slash pines	7,504	2,103	659	10,266	42.2
Turpentined pines	3,429	1,485	296	5,210	21.4
Loblolly and other pines	5,237	2,445	1,155	8,837	36.4
Total	16,170	6,033	2,110	24,313	100.0
Percent of total	66.5	24.8	8.7	100.0	

Forest Increment

The net annual forest increment is the volume added by growth to the individual trees, plus the merchantable volume newly created by small trees developing into merchantable sizes during the year, and minus the losses due to natural mortality and the effect of turpentining. This net accretion of the forest represents, in a general way, the amount which forest industries could cut without depleting the total volume of the present growing stock. As previously explained, the climate in southwest Alabama is favorable for forest growth, and the sites are usually fair or good. Owing to past treatment, however, the stocking is generally poor, and, as a result, the net increment is only a fraction of what it could be under management.

In 1935, the gross growth amounted to 768 million board feet, green lumber tally (based upon the International $\frac{1}{4}$-inch rule), and the mortality was 107 million board feet, leaving a net increment (table 13) of 661 million board feet before deducting the commodity drain for the year. Over four-fifths of the increment occurred in second-growth stands, the trees of which are usually poorer for lumber production than those of the old growth.

Almost three-fourths of all the increment was pine. As the old-growth stands are disappearing, the forest industries, however, are adapting themselves to the inevitable change in the quality of their resources; an excellent example is the rapid expansion of the pulp and paper industry, for which second-growth timber is entirely satisfactory. Practically all of the longleaf and slash pine increment was in the southern portion of the area; most of the loblolly and other pine, in the northern part.

Table 13. - Net increment, 1935

Forest condition	Saw-timber material				All growing stock	
	Species-group			Total		
	Longleaf and slash pines	Loblolly and other pines	Hardwoods and cypress			
	Thousand bd.ft., green lumber tally				Cords[1]	Thousand cu.ft.[2]
Old growth	36,500	22,700	62,000	121,200	409,200	28,760
Second growth:						
Sawlog size	86,000	211,400	79,500	376,900	1,201,700	86,520
Under sawlog size	66,400	64,400	27,600	158,400	907,600	62,880
Reproduction and clear-cut	3,400	200	500	4,100	33,800	2,320
Total all conditions	192,300	298,700	169,600	660,600	2,552,300	180,480
Total southern part	156,400	36,800	50,800	244,000	1,001,000	70,490
Total northern part	35,900	261,900	118,800	416,600	1,551,300	109,990

1/ Rough wood, including bark

2/ Inside bark.

In 1935 the net increment, before making deductions for commodity drain, amounted to about 2½ million standard cords of rough wood (bark included), as shown in table 13. This included the growth upon the growing-stock trees 5.0 inches d.b.h. and larger, but no allowance was made for the growth of culls or for the upper stems and limbs of hardwood and cypress. Longleaf and slash pines made up 25 percent of the total net cordwood increment; loblolly and other pines, 39 percent; and hardwoods and cypress, 36 percent. It is roughly estimated that more than half the hardwood and cypress increment was in pulping hardwoods and cypress.

It may be estimated roughly that, in 1935, turpentining in the southern part of the area caused a loss in net increment of the longleaf and slash pines of approximately 75 million board feet, of which 43 million was the difference in growth between the turpentined trees and the faster growth these trees would have made if they had been left round, 28 million was the additional tree mortality caused by turpentining, and 4 million was lost in the unusable portions of turpentined butts.

The average increment per acre for 1935 in board feet, assuming that the stands were not influenced by cutting, compared very favorably with that in other parts of the South and, in general, was greater in the northern part of the area than in the southern part (table 14). For all the forest

Table 14. - Average net increment [1] per acre, 1935

Forest condition	Saw-timber material				All growing stock 5 inches and larger
	Species-group component			Total	
	Longleaf and slash pine	Loblolly and other pine	Hardwood and cypress		
	Board feet [2]				Cords [3]
Southern part of the area					
Old growth	53	11	50	114	.42
Second growth:					
Sawlog size	112	41	24	177	.56
Under sawlog size	46	5	7	58	.33
Weighted average [4]	54	13	17	84	.34
Northern part of the area					
Old growth	17	41	84	142	.42
Second growth:					
Sawlog size	17	165	57	239	.76
Under sawlog size	9	58	20	87	.51
Weighted average [4]	13	98	44	155	.57
Southwest Alabama					
Old growth	38	24	64	126	.42
Second growth:					
Sawlog size	50	122	46	218	.69
Under sawlog size	30	29	12	71	.41
Weighted average [4]	34	54	30	118	.45

[1] Uninfluenced by cutting.

[2] Green lumber tally, based on the International $\frac{1}{4}$-inch rule.

[3] Rough wood, including bark.

[4] Includes the reproduction and clear-cut areas.

land, including reproduction and clear-cut areas, the average net increment per acre in 1935 was 118 board feet, or for all growing-stock trees 5.0 inches and larger, 0.45 cords of rough wood, including bark. The most rapid net increment (218 board feet per acre) occurred in the sawlog-size second-growth stands. Old-growth stands, uncut and partly cut conditions combined, which are usually slow growing, had an increment per acre of almost 126 board feet

of saw-timber material. For the second-growth under-sawlog-size condition where only a few trees are large enough to be measured in board feet, the saw-timber increment averaged only 71 board feet per acre, but the cordwood increment, based upon all growing stock 5 inches d.b.h. and larger was 0.41 cords——almost equal to that of the old growth.

Forest Industries

Lumber industry

Lumbering, the most important wood-using industry, became active in southwest Alabama about 1870. In 1936, there were 261 sawmills, and the total lumber cut by these mills, regardless of whether the stumpage was within or without this area, amounted to nearly 467 million board feet (table 15). The total rated capacity of the mills per 10-hour day was $3\frac{1}{2}$ million board feet; and, based upon 250 working days per year, it is apparent that the sawmills had a cutting capacity almost twice their actual production. Since many of the small mills, however, are owned by farmers and are operated only during slack seasons, they seldom if ever reach a capacity cut. The average production per mill for 1936, all mills included, was 1.8 million board feet; for the large mills (i.e., those with a daily capacity of at least 40,000 board feet), 12.0 million board feet; for the medium-sized mills (20,000 to 39,000 board feet per day), 4.4 million feet; and for the small sawmills (with a daily capacity of 1,000 to 19,000 board feet per 10-hour day), 700,000 board feet. The majority of the large sawmills are in the southern part (Alabama Unit #1), while most of the medium-sized and small sawmills are in the northern part (Alabama Unit #2), as shown in figure 4. Pine made up over four-fifths of all the lumber cut, hardwoods made up most of the remainder, and only a small amount of cypress was cut.

Table 15. - Number and size of sawmills, and amount of lumber cut by species, 1936

Daily (10 hrs.) rated capacity	Number of sawmills	Lumber cut		
		Pine	Hardwood and cypress	Total
- Thousand board feet -		- - - - Thousand board feet - - - - -		
1 - 19	211	139,800	9,100	148,900
20 - 39	37	132,200	29,300	161,500
40 - 79 1/	13	116,700	39,700	156,400
Total	261	388,700	78,100	466,800

1/ Includes 2 mills with a daily capacity of at least 80 thousand board feet.

Other forest industries

While sawmills were the most numerous of all forest industries and provided by far the greatest employment, other forest industries were also

important in this area (table 16). In 1936, in addition to sawmills, the well-integrated forest-products industries included about 110 gum naval stores stills, 2 pulp mills [8], 9 veneer mills, 2 wood-distillation plants, 10 cooperage plants, 2 wood-treating plants, and 21 miscellaneous mills such as shingle and bobbin mills. The two operating pulp mills used only pine, but one of the new mills is expected to use both pine and hardwood. Veneer mills making furniture and box stock were dependent upon magnolia, yellow poplar, and black, tupelo, and red gums, while the cooperage plants making slack and tight barrel stock used pines, white oaks, red oaks, and gums. As shown on the map (fig. 4), most of the nonlumber forest industries were in Alabama Unit #1, and many were in or near the city of Mobile.

Table 16. - Number of forest-products industries and man-days of employment, 1936

Industry or commodity	Number of plants	Man-days (10-hrs. each) of employment		
		Woods	Plant and office	Total
		- - - Thousand man-days - - - -		
Sawmills				
Small	211	165	319	484
Medium	37	207	321	528
Large	13	278	329	607
Total	261	650	969	1,619
Fuel wood [1]	-	1,141	-	1,141
Gum naval stores [2]	110	805	50	855
Pulpwood	2	178	252	430
Veneer	9	49	95	144
Wood distillation	2	86	23	109
Cross ties	-	74	-	74
Cooperage	10	17	18	35
Miscellaneous manufacturing	21	11	24	35
Poles and piles	-	33	-	33
Fence posts	-	28	-	28
Treating plants	2	-	21	21
Total		3,072	1,452	4,524

[1] Includes 124,000 man-days used in producing commercial fuel wood.
[2] Data as of 1934.

In 1936 all forest industries combined furnished about 4½ million man-days of employment, of which lumber and other wood-products industries accounted for over 3½ million, and naval stores, both gum and wood, almost 1 million. Since the harvesting, transportation, and manufacture of forest products is to a large degree a part-time occupation for the inhabitants of the area, it is

[8] Not included are a pulp mill under construction in 1937 and another one planned for 1938, both at Mobile.

difficult to translate the man-days of labor required into number of people actually employed, but it is probable that more than 50,000 men were employed in forests and mills full or part time during the year.

Commodity Drain from the Growing Stock

The total volume of wood removed from the sawlog-size trees of the growing stock of this area for use in industry and for domestic purposes in 1936 was the equivalent of 733 million board feet; or from all sound trees at least 5 inches d.b.h., about 163 million cubic feet, inside bark (table 17), or over 2 million cords of wood with the bark. This commodity drain, which should not be confused with the losses due to natural mortality, is the material removed, including (a) the material cut in the two Survey units for use in or shipment out of the area and (b) the waste incidental to the various logging operations. Material cut and utilized from the dead and cull trees is not included.

Table 17. - Commodity drain from sound trees, 1936

Commodity	Saw-timber material				Volume all material	
	Pine	Hardwood	Cypress	Total	Rough wood	Inside bark
	- - - Thousand board feet (green lumber tally) - - -				M cords	M cu.ft.
Lumber	453,500	78,200	5,500	537,200	1,275.4	97,620
Fuel wood	51,000	33,500	-	84,500	464.9	33,200
Pulpwood	18,400	-	-	18,400	166.0	12,420
Veneer	600	29,600	-	30,200	56.3	4,340
Cross ties	13,600	9,600	1,000	24,200	60.4	4,600
Cooperage	4,500	2,700	-	7,200	20.1	1,540
Miscellaneous manufacturing	1,000	2,300	400	3,700	14.4	1,050
Poles and piles	15,500	-	600	16,100	40.0	3,070
Fence posts	-	600	100	700	11.3	780
Miscellaneous farm use	8,200	2,800	-	11,000	58.1	4,190
Total for southwest Alabama	566,300	159,300	7,600	733,200	2,166.9	162,810
Total southern part	194,700	40,500	2,400	237,600	733.8	55,400
Total northern part	371,600	118,800	5,200	495,600	1,433.1	107,410

Approximately two-thirds of the saw-timber drain of 733 million board feet came from the northern counties of this area, one-third from the five southern counties. Also of importance is the fact that the pine-tree component of the forest made up slightly more than three-fourths of the saw-timber drain. As is to be expected, the greater part of the saw-timber drain resulted from the manufacture of lumber. The cutting of fuel wood was responsible for 12 percent of the drain from saw-timber material, although it would be

thriftier to take such low-priced commodities from the great supply of wood in undesirable trees now largely going to waste.

The part of the total commodity drain against the sound-tree growing stock of the forest that is drawn from nonsaw-timber material in trees under sawlog size and on upper stems of sawlog-size pine trees is not measured in board feet, and this amount is not included in the saw-timber drain discussed above. In 1936 this drain amounted to 48 million cubic feet, or the equivalent of 667,000 cords. The total commodity drain from both the saw-timber and the nonsaw-timber components of the growing stock was, as stated before, 163 million cubic feet, or the equivalent of over 2 million cords of wood with bark.

The total commodity drain for 1936 against the sound-tree growing stock is itemized in table 17 and allocated to the commodities for which the trees were cut.

Comparison of Increment and Drain

From the field inventory taken in 1934 and 1935, and from subsequent adjustments made for net increment and commodity drain, the following changes in growing stock are estimated to have taken place:

Date	Saw-timber growing-stock material			All growing-stock material
	Pines	Hardwood and cypress	Total	
	M board feet (green lumber tally)			M cubic feet (inside bark)
Jan. 1, 1935	8,112,000	4,041,500	12,153,500	3,453,990
Jan. 1, 1936	8,175,400	4,043,700	12,219,100	3,501,600
Jan. 1, 1937	8,095,500	4,046,700	12,142,200	3,524,110

From the figures given above, it is apparent that no important change has taken place in the forest growing stock during the 2-year period, Jan. 1, 1935 - Jan. 1, 1937; the saw-timber part has been reduced less than 0.1 percent, and the entire growing stock, including under-sawlog-size trees, has increased over 2 percent.

In 1936, the commodity drain of saw timber was nearly 77 million board feet greater than the net increment (table 18), and practically all the overcutting of this class of material occurred in the northern part of the area (fig. 8). For the pines (all pine species combined), the drain exceeded the net saw-timber increment; while for the hardwoods and cypress (combined for the entire area) the increment slightly exceeded the drain. In the old-growth stands, all species combined, the drain from saw-timber volume was nearly three times the corresponding net increment, while in the second-growth conditions there was a surplus increment of about 130 million board feet. Thus it is apparent that some of the large sawmills that now take practically all their cut from old growth may in time be forced to change to second growth. Some of the companies are anticipating this and are wisely practicing selective logging, designed to keep up the supply of high-grade material through continued growth and development of the younger trees of these stands.

Table 18. - Comparison of increment with commodity drain in board feet and cubic feet, 1936

Item	Saw- timber material			All growing stock
	Pine	Hardwood and cypress	Total	
	M bd. ft. (green lumber tally)			M cu.ft. (i.b.)
Growing stock, Jan. 1, 1936	8,175,400	4,043,700	12,219,100	3,501,600
Growth	563,300	200,400	763,700	216,680
Mortality	76,900	30,500	107,400	31,360
Net increment	486,400	169,900	656,300	185,320
Commodity drain	566,300	166,900	733,200	162,810
Net change in growing stock	-79,900	3,000	-76,900	22,510
Growing stock, Jan. 1, 1937	8,095,500	4,046,700	12,142,200	3,524,110

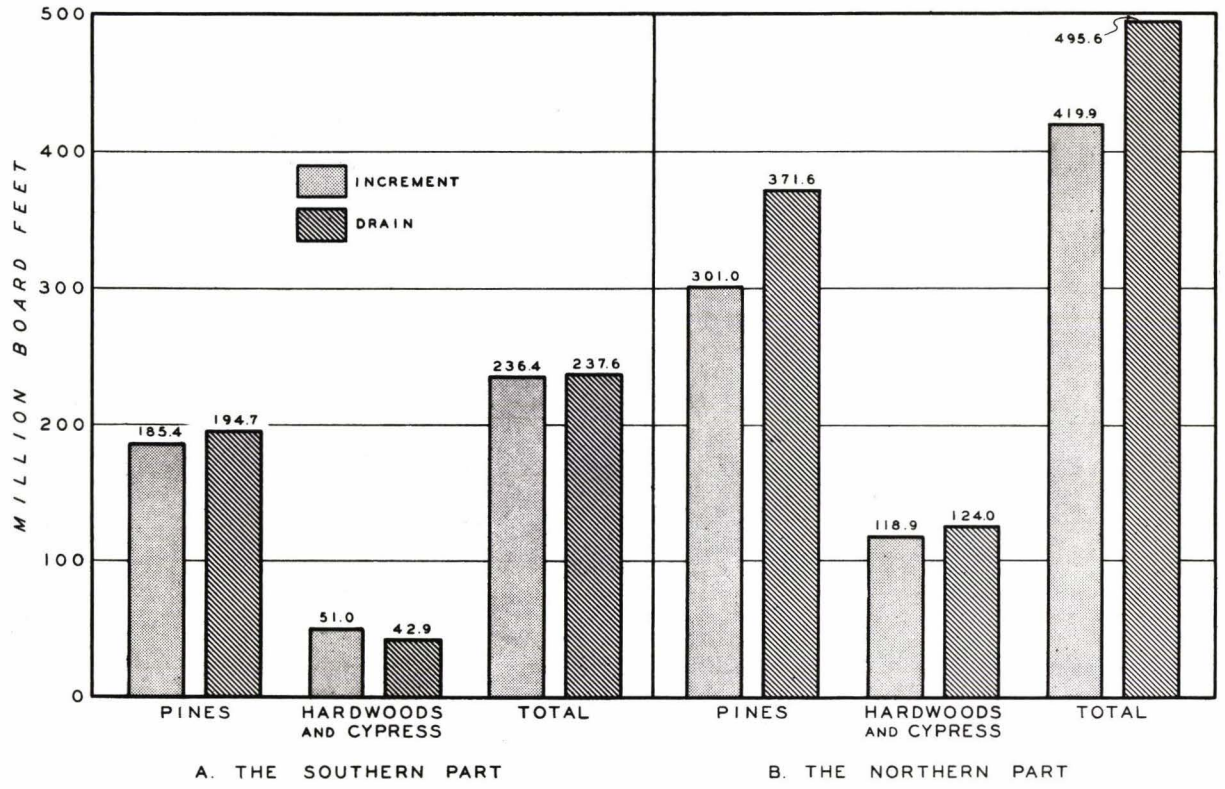


FIGURE 8 – COMPARISON OF NET INCREMENT OF SAWLOG-SIZE MATERIAL WITH THE COMMODITY DRAIN, 1936.

In spite of a mortality loss of 31 million cubic feet, the net increment in 1936 on all growing-stock trees 5.0 inches d.b.h. and larger, shown in cubic feet i.b., was almost 23 million cubic feet greater than the total commodity drain. The net increment was 30 percent greater than the commodity drain for the southern part of the area but only 5 percent greater for the northern part. It should be remembered, however, that these ratios are subject to change from year to year, and that the fluctuations are largely influenced by the demand for, and market price of, lumber and other products.

According to the best information available, the forest industries in this area operated in 1936 at a rate considerably higher than for any of the 5 preceding years. There will be a real threat to the integrity of the growing stock and to the future supply for forest industries if this already high rate of cutting is increased or continued without a corresponding increase in the forest increment. The situation demands that a strong effort be made by both public and private agencies to improve growing conditions and to augment both the quality and quantity of the forest growth.

Summary of Present Situation and Outlook for the Future

The forest in the economic picture

Southwest Alabama with more than 7 out of every 10 acres in forest is an important timber area. At the time of the survey, about one-seventh of the crop land and pasture land, or about 300,000 acres, was idle or abandoned, and it is likely that a large part of this will revert to forest growth. Forest industries create an income for payrolls, taxes, and capital profits second only to that of agriculture. About 260 sawmills, 110 turpentine stills, 2 pulp mills, 9 veneer mills, 10 cooperage plants, and other forest industries provided in 1936 about $4\frac{1}{2}$ million man-days of employment (10 hours each). The security and prosperity of these industries, of a very large proportion of the working people of the territory, and of the railroads, the port of Mobile, ship and barge lines, and other transportation facilities, depend in large measure upon the continued productivity of the forests. Furthermore, the local governments, both state and county, must continue to look to the forests of the region as a source of tax income.

Deficiencies in the present forest

The chief reason why the present forest yields are less than half of the capacity of the site is that the stocking (i.e., the number of desirable trees per acre) is less than half of what it should be. A half-stocked forest is similar to a field of corn with alternate rows missing. In addition to being lightly stocked, many of the trees are culls; fires have often been carelessly or purposely set and allowed to spread in the stands, with the result that many of the small trees needed to restock the area have been killed, and a large proportion of the survivors have been damaged so badly as to restrict their use for all except the very lowest class of commodities. Also many forest owners have reduced both the quality and quantity of their growing stock by severe turpentining, by continually overdrawing on the productive capacity of their stands, and by cutting the best and leaving the worst.

Measures for improvement

With fire protection, abundant natural reforestation generally can be expected within a short time in most of the poorly stocked stands. Organized fire protection should be extended to every forest holding in the area and should be made more effective not only through increased detection and suppression facilities but also through intensive education among landowners of all classes and the public generally concerning the need for fire protection. The funds available under the Clark-McNary Act should be greatly increased in order to put this all-important work upon an effective, state-wide basis.

Artificial reforestation may be necessary to restore quickly some of the clear-cut lands to a high degree of forest productivity, but the adoption of selective-logging practices or the systematic leaving of adequate seed trees, with protection from fire, usually will make artificial reforestation on recently logged areas unnecessary.

Non-conservative measures of turpenting, such as deep-chipping, over-cupping, and working small trees, in the long run have proved unprofitable to the landowner and operator alike and have deteriorated many of the longleaf and slash pine stands. Some of the operators are changing to more conservative practices, and a more widespread adoption of better methods will do much to check the retarded tree growth and the increased mortality caused by turpentining, and will make possible greater yields of both gum and wood products.

The presence in the stands of cull trees and worked-out turpentine trees is retarding both the growth and restocking on a large part of the area. These two classes of undesirable trees, which together contain over 11 million cords of sound material, should be cut wherever possible, and utilized for lumber, poles, pulpwood, firewood, or other products. Their removal and utilization not only will supplement the current wood supply and encourage faster growth of the remaining trees, but also will leave space for oncoming crops of new trees of good quality. Closer utilization in cutting for forest products should be practiced, since with the expanding markets for pulpwood, much of the waste now left in the woods to rot could be consumed profitably.

An integration of the demands of the various forest-products industries is obviously a prerequisite for close and profitable utilization. Industries cutting lumber, poles, piles, and veneer depend upon high-quality stumpage and, in their own interest, landowners and timber users should use great discrimination in the use of forest products and should sell only low-quality material for pulpwood, fuel wood, and similar products. Similarly the pulpwood, cross-tie, and other industries dependent upon relatively low-grade material in order to avoid direct competition with other industries and thus keep costs of their supply at a low figure, should meet their needs as much as possible from culls, worked-out turpentine trees, and other trees and parts not suitable for higher-priced products. Landowners will profit by recognizing quality grades in their trees and by selling their material for the commodities paying the highest price.

To get these essential forest-improvement measures put into practice on a large scale, an intensive and expanded program of forestry education and co-operation is essential. Almost all of the forest acreage is in private holdings, most of which are small. For the owners of small tracts, greatly expanded

forestry extension work along the lines of the present agricultural educational activities under the Smith-Lever Act seems the best method of approach. Personal contacts, demonstration areas, sample marking, elementary forestry courses in the schools, etc., will build up an appreciation of good forestry and its possibilities, as well as train individuals in the latest methods of fire protection, planting, thinning, selective logging, and other phases of forest management.

In summing up the forest-ownership situation, it is recalled that only 3 percent of the forest land is in public ownership; 25 percent is in farm woodlands; and 72 percent is in privately owned industrial forests (i.e., owned by sawmills, pulp mills, etc.) or in investment forests. A study of the forest practices on privately owned non-farm forest land recently made by the Division of State and Private Forestry of Region 8 of the Forest Service discloses that for 123 known properties (which in the aggregate cover 2,462,000 acres) approximately 68 percent of the forest land is "handled under good forestry practices for continuous forest crops"; 24 percent under practices that are "poor" but that leave the land productive; and only 8 percent is in "lands not left productive".

Although the present forest increment generally does not warrant an expansion in utilization, additional industries are needed for the full economic development of this area. The people need the payrolls which would come with expanded industry, for the unemployment census taken Nov. 16-20, 1937, classes about 24,000 people in this area as unemployed and wanting work. A new pulp mill is under construction, and the site has been purchased for still another. Recent developments in the use of southern tree species for paper, rayon, and other products have given added value to the forests of southwest Alabama. If the growing stock is to be maintained, however, only the net increment can be cut and, using 1936 as a basis, it is seen that the forest increment approximately balances the commodity drain. The only way, therefore, to supply permanently the needs of an expanded forest industrial structure is by increasing the net increment. By fire protection, planting, stand-improvement cuttings, better utilization, and the adoption of more conservative methods of turpentining and logging, this should not be difficult to do; and since the stands respond readily to improvement under forest management, there is thus a real opportunity to build up the poorly-stocked forest so that it will produce possibly twice its present yields.